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U. S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH ADMINISTRATION
BUREAU OF ANIMAL INDUSTRY
and
COOPERATING WESTERN STATES

W-1 - IMPROVEMENT OF BEEF CATTLE THROUGH THE APPLICATION OF
BREEDING METHODS

Report of

Annual Meeting of Technical Committee

Las Cruces, New Mexico

October 8, 9 and 10, 1951

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1. The first part of the paper
discusses the general principles
of the theory of the
relativity of simultaneity.

2. The second part of the paper
discusses the special theory of
relativity.

3. The third part of the paper
discusses the general theory of
relativity.
4. The fourth part of the paper
discusses the applications of the
theory of relativity.

ANNUAL MEETING
W-1 TECHNICAL COMMITTEE
State College, New Mexico
October 8, 9, and 10, 1951

PROGRAM

October 8

7:30 A.M. Meet at Courthouse in Las Cruces for Ranch Day Tour.

October 9 Sun Room, Milton Hall, New Mexico College of Agriculture
and Mechanic Arts

N. W. Hilston, Chairman

8:30 A.M. Report of Committee on Selection

Report of Committee on Carcass Evaluation

A Stockman's Opinion of What a Beef Cattle
Breeding Project Should Accomplish -
A. D. Brownfield, Deming, New Mexico

11:30 A.M. Luncheon, College Cafeteria

1:00 P.M. Inspection of Registered Hereford Herd and Discussion
of Breeding Program

3:00 P.M. Business Session

6:30 P.M. Dinner, Dining Room, Milton Hall

7:30 P.M. Illustrated Discussion on Dwarfism -
P. W. Gregory, University of California

October 10

8:00 A.M. Business Session

12:00 Noon Luncheon

1:00 P.M. Final Business Session

ANNUAL MEETING
W-1 TECHNICAL COMMITTEE
State College, New Mexico
October 8, 9, and 10, 1951

MINUTES

W-1 Technical Committee members present:

Arizona - - - - -	O. F. Pahnish
California - - - - -	P. W. Gregory
Colorado - - - - -	J. E. Ingalls
Idaho - - - - -	T. B. Keith
Montana - - - - -	F. S. Willson
Nevada - - - - -	J. F. Kidwell
New Mexico - - - - -	R. M. Durham
Oregon - - - - -	Ralph Bogart
Utah - - - - -	J. A. Bennett
Washington - - - - -	M. W. Galgan
Wyoming - - - - -	N. W. Hilston

W-1 Regional Coordinator - - - - -	C. F. Sierk
Regional Administrative Adviser - - - - -	Clyde McKee

National Coordinator - - - - -	R. T. Clark
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Bureau of Animal Industry - - - - -	T. H. Bartilson
	J. R. Quesenberry

Office of Experiment Stations - - - - -	Chas. Grey
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Guests attending were:

Arizona - - - - -	C. E. Saffley
New Mexico - - - - -	A. S. Curry
	J. H. Knox
	P. E. Neale
	W. E. Watkins
	J. D. Mankin
	W. E. Flint
	Ivan Watson
	A. D. Brownfield
Wyoming - - - - -	C. B. Reubinek

RANCH DAY TOUR

On October 8, the Technical Committee participated in Ranch Day. This is an annual event to which the public is invited, and is jointly sponsored by New Mexico College of Agriculture and Mechanic Arts and the Southwest Forest and Range Experimental Station. The program, which was held on the College Experimental Ranch and the Jornada Experimental Range, included talks and demonstrations by Profs. J. H. Knox, W. E. Watkins, and R. M. Durham of the College staff, and members of the staff of the Range Experimental Station. A chuck wagon lunch was served at noon, followed by a program of talks and demonstrations which included a discussion of the dwarf problem by Dr. P. W. Gregory of the University of California, and a talk and demonstration by George Ellis, Manager of the Bell Ranch, Tucumcari, New Mexico, on breeding productive beef cattle. Approximately 250 people were in attendance.

TECHNICAL COMMITTEE MEETING

The meeting was called to order in the Sun Room of the Student Union Building at 8:30 A.M. In attendance were the Technical Committee members and guests, and a representative group of ranchers who are cooperating with the New Mexico Agricultural Experiment Station and Extension Service in keeping records on their ranches. Associate Director Curry welcomed the group to the Station. Dr. N. W. Hilston, Chairman of the Technical Committee, then called upon Mr. W. E. Flint, Extension Animal Husbandman, to describe briefly the cooperative work with the ranchers, and Dr. R. M. Durham to tell the ranchers the nature of the Technical Committee. Dr. Ralph Bogart then reviewed the report of the Selection Committee, copies of which had previously been sent to each Technical Committee member. An interesting discussion followed his report, with the ranchers and Technical Committee members participating. A copy of the Selection Committee report follows:

SELECTION IN BEEF CATTLE

C. F. Sierk

Selection, to the livestock man, is deciding which animal will be given an opportunity to reproduce and is the converse of culling or deciding which of the available animals will not be permitted to reproduce. These two processes, selection and culling, have been practiced since the domestication of animals. Selection is one of the three tools which the livestock breeder has at his disposal in his efforts to improve animals. Inbreeding and crossbreeding are the other two. That a great deal has been accomplished by selection is attested to by a comparison of the performance of animals of today with those of say fifty years ago. Not all the credit for improvement in performance can be attributed to selection since it is common knowledge that considerable progress has been made in improving environmental conditions, including nutrition, control of diseases, and management. The fact remains, however, that selection has played a major role in the development of our breeds of livestock as we know them today.

The purpose of selection is to improve the genotype or breeding potential of a herd or flock. It is quite obvious that considerable improvement can be made in the appearance of a herd of beef cattle by culling out the under-developed and otherwise misfit individuals, but unless the culling process results in an improvement in the breeding potential the efforts have been wasted.

It would perhaps be well at this time to attempt to define or at least to have an understanding as to just what factors or characteristics are involved when we talk about improvement in beef cattle. Certainly the most obvious trait is body form. It is generally agreed that the beef cattle that appear on our markets and that populate our farms and ranches today are on the average quite superior in beef type or conformation when compared with those of fifty years ago. It is also agreed that along with that improvement in body form of the live animal there has come a more desirable carcass, both from the standpoint of a greater percentage of preferred cuts as well as an increase in the quality of the meat. There are indications at least that there has been some improvement in the time required to reach a satisfactory market weight and grade. There are a number of other important factors in economical beef production, however, in which there is not general agreement as to the extent of improvement. These are factors that, up until rather recent times, have not been considered to be as important as those just mentioned, or it has been assumed that there is a very close association or relationship of these factors and desired body form or type. A list of these factors or characteristics would include such important traits as regular reproduction, adequate milk production, environmental adaptation--all of which might be grouped together and referred to as "cow productivity", and rate and efficiency of gain in the feed lot.

A study of beef production from an economic standpoint leads to a quite definite conclusion that these performance factors are of considerable importance. Studies of data that have been gathered over a period of ten years or more at several different experiment stations indicate rather conclusively that there is not a close association or a high relationship of these performance factors and body form or type. Acceptance of these findings leads one to two unescapable conclusions, one, further improvement in beef cattle will result only from a consideration of all the factors that contribute to economical beef production, and two, accurate records or data must be available on each one of these factors.

Since the inception of the nation-wide Beef Cattle Improvement Program in 1946, and prior to that at individual State and Federal Experiment Stations, efforts have been directed primarily toward assembling herds and lines of cattle, devising practical methods for obtaining the necessary data, determining the relationship of these different factors, and determining to what extent these various performance factors are influenced by heredity. While considerable progress has been made toward the solution of these problems it is quite apparent that there still remains much to be learned not only as regards fundamental concepts and their inter-relationships but in the application of

these findings. Obviously it is the application of these findings that will make possible more intelligent selection and put us on the road toward the development of more productive herds of beef cattle. While our findings to date may not be sufficient, it seemed to us that a review should be made and the possibility explored of developing an index that could be used in selecting those animals which seem to possess the maximum potential for bringing about the most rapid and lasting improvement in beef cattle. With that in mind a committee was appointed to appraise the situation.

The Over-All Effects of Single Trait and Index Selection in Beef Cattle

H. H. Stonaker
Colorado A. & M.

There is a large amount of experimental data to indicate that selection is effective in bringing about genetic change. Generally this evidence is based upon experiments where but a single trait was subjected to selection. It is becoming more apparent that selection for one trait has something other than a random effect on other traits. In order to examine the results which selection for one trait has on other traits in cattle, we have developed an example from the steer data of the Colorado Agricultural Experiment Station. The steers in this test were of conventional type, individually fed a fattening ration from weaning time until they reached a grade of high choice to low prime (new standard). The 61 steers were purebred and sired by fourteen different bulls. They were produced and fattened in three different years. For the purpose of our example we will assume that these animals were breeding cattle and that we are able to cull the bottom 75 per cent on the basis of their performance and save the top 25 per cent for breeding.

In measuring performance we will assume that breeders do not agree on what trait or traits they wish to emphasize. However, in order to keep the problem simple, we will use a situation in which a breeder is selecting for but one trait at a time. If the breeder does this, the question arises as to whether or not a certain amount of positive or negative selection is automatically occurring for the traits on which he has placed no purposeful attention or selection pressure. If the breeder must have 25 per cent replacements, and is selecting for but one trait, then he is making the greatest possible reach in an attempt to improve the one trait. In our problem, the difference between the selected and culled for the desired trait will be considered to be equal to 1.00 or 100 per cent. In the example we will use seven different breeders, each having worked toward a different goal. The first breeder selected for high grade at weaning, the second for high commercial grade at slaughter time, the third for compactness, the fourth for high weaning weight, the fifth for a large final feedlot weight, the sixth for fast daily gain, and the seventh for high efficiency of feed utilization. All of these traits have gross or net income value. As yet it is not established as just what these values may be. However, it is interesting to examine the over-all results of the selection efforts of each of

these hypothetical breeders. The three year summary based upon records of steers individually fed to a fat constant basis are given in Table 1. From this table we can estimate the selection pressure - both purposeful and automatic taking place for each of the breeders.

The first breeder selected for high grade at weaning and for that trait he made the maximum selection pressure possible. However, when the performance of his cattle in other traits is examined the automatic selection which occurred resulted in lower than average slaughter grades, about average compactness, 40 per cent as much reach in weaning weight as made by the fourth breeder, practically no increase in final weight and he has selected calves which are below average so far as daily gain and efficiency are concerned.

The second breeder, the one which selected for high slaughter grade (grade as fat yearlings) automatically reaped the results of having breeding cattle which were slightly above average in initial grade, compactness, weaning weight and final weight and a very little under average in daily gain and efficiency.

The third breeder selected for compactness and he also had cattle considerably above average in slaughter grade, a little better than average in weaning weights, they were considerably lighter when finished and had a much lower daily gain, although they were a bit above average in efficiency of feed utilization.

Table 1. --Means of Top 25 per cent and Bottom 75 Per Cent of Performance Tested Cattle When Such a Division is Made on the Basis of Each of the Characters Preceding Each Row: (n = 61)

Single Selection Goals:		I.G.	S.G.	C.G.	W.W.	F.W.	D.G.	E.	I.
Initial Grade	Saved	<u>5.33</u>	4.28	4.32	406.28	857.36	2.04	4.99	
	Culled	<u>4.19</u>	4.37	4.27	379.87	852.04	2.17	4.72	
	Selection	<u>7.00*</u>	<u>-.22</u>	.12	.40	.05	-.38	-.52	
Slaughter Grade	Saved	4.61	<u>4.59</u>	4.36	401.33	869.86	2.12	4.84	
	Culled	4.45	<u>4.27</u>	4.25	381.81	840.43	2.14	4.75	
	Selection	.10	<u>1.00</u>	.29	.30	.22	-.08	-.04	
Compactness Grade	Saved	4.50	4.48	4.70	393.72	823.33	2.07	4.78	
	Culled	4.48	4.30	<u>4.15</u>	384.73	863.71	2.16	4.80	
	Selection	-.01	.46	<u>1.00</u>	.11	-.37	-.29	<u>1.07</u>	
Weaning Weight	Saved	4.70	4.43	4.31	<u>437.67</u>	884.45	3.15	4.90	
	Culled	4.41	4.32	4.27	<u>369.07</u>	841.95	3.13	4.75	
	Selection	.25	.27	.01	<u>1.00</u>	.39	.05	-.29	
Final Weight	Saved	4.68	4.44	4.11	409.58	<u>933.75</u>	2.33	4.81	
	Culled	4.42	4.32	4.34	378.76	<u>825.00</u>	2.06	4.79	
	Selection	.21	.31	.13	.46	<u>1.00</u>	.81	-.00	
Daily Gain	Saved	4.32	4.40	4.22	401.78	913.19	2.38	4.56	
	Culled	4.54	4.33	4.31	381.43	831.91	<u>2.05</u>	4.87	
	Selection	-.18	.28	-.19	.31	.75	<u>1.00</u>	.53	
Efficiency	Saved	3.93	4.27	4.43	350.78	812.36	2.22	<u>4.37</u>	
	Culled	4.69	4.37	4.23	399.47	867.37	2.11	<u>4.94</u>	
	Selection	-.60	-.30	.37	-.70	-.50	.33	<u>1.00</u>	
Index Selection		-.37	.58	.03	.41	.21	.48	.54	1.00

* Purposeful selection underlined, automatic selection is represented as a fraction of that taking place when purposeful selection for the trait was exercised.

Scores: 6 = fancy or prime, 5 = choice, 4 = good, 3 = medium

The fourth breeder stressed weaning weight. How did his cattle perform on other traits? They were above average in initial grade, slaughter grade and final weight, above average in compactness and daily gain but considerably less efficient than average.

The fifth breeder wanted heavy cattle at market time. His cattle were also above average in initial grade, slaughter grade, and weaning weight. The cattle made almost as fast daily gains as those selected for that trait. They would be about average in efficiency of feed utilization.

The sixth goal was that of selecting for daily gain. For other traits, these cattle were under average in initial grade and in compactness but had a somewhat higher than average weaning weight and slaughter grade. They had almost as great a final weight as the cattle selected specifically for that trait and showed a considerably higher than average efficiency.

If the breeder selected for efficiency of feed utilization alone, what happened to the other traits of these selected animals? They were relatively low in initial grades, slaughter grades, weaning weights, and final weights but somewhat above average in compactness and daily gain.

A more precise procedure in evaluating these relationships between traits is provided by pooled intra-year phenotypic correlations between the traits. Among the higher correlations is the one between feedlot weight when finished and daily gain. This again would indicate that selecting for greater daily gains would also be selection for heavier weights when fat. The correlation between weaning weight and initial or weaning grade is also high. Initial grade, weaning weight, and daily gain in feedlot were about equally correlated with efficiency of feed utilization. So far as these data indicate, efficiency in fat constant feeding trials could be predicted about as closely from initial grade or weaning weight as from daily gain, which is more generally used as a guide to efficiency. Calves which weigh less and grade lower thus are probably thinner when starting on test and are more efficient than fatter, heavier weaners. Weaning weight and grade were considerably more closely correlated with efficiency than with daily gain.

From these analyses it appears that:

1. Selection pressure on any one trait does not leave the other traits unaffected. The automatic by-product effects may be either in a positive or negative direction.
 - a. The most efficient cattle have been those which apparently were relatively thin and light at the beginning of feeding trials.
 - b. The fastest gaining cattle were those which were thin but heavier than average at the beginning of the trials and considerably heavier than average at the time they were sufficiently fat for slaughter.
 - c. The heavier weaners were about average in feedlot gains but low in efficiency.

It becomes recognizable that we need to know much more concerning the causes of these positive and negative correlations. Are they due to the pleiotropic effects of genes? Are they due to patterns set up by environmental conditions? Probably these phenotypic correlations between traits are due to both causes and the relative size of the environmental and genetic correlations should be known if the breeder is to select most wisely.

Procedures for evaluating these relationships are available and application to the problem of beef cattle selection should soon be possible.

The most efficient procedures for indexing animals was that originally devised by Hazel (1941). His index included information on the heritability of traits, genetic correlations between the traits and relative economic importance of the traits. Indexes based on this type of information have increased efficiency of selection in swine and sheep breeding experiments. Until such time as the necessary information becomes available for beef cattle "rule of thumb" indexes have been used at the Colorado Station in putting selection on a more objective basis. These first selection guides have been based upon the rough assumptions that standard deviations in weaning weights, efficiency of feed utilization, and yearling grade are of about equal heritability and equal in economic importance. It assumes also similar genetic correlations between all traits.

Thus the index for yearling bulls used at the Colorado Experiment Station is:

$$I = \frac{w}{\sigma_w} + \frac{y}{\sigma_y} + \frac{e}{\sigma_E}$$

I = index

w = deviation of bull's corrected weaning weight from the mean of weaning weights.

y = deviation of bull's yearling grade from the mean of yearling grades.

e = deviation of bull's efficiency from the mean of efficiency of feed utilization.

σ_w , σ_y , σ_E represent standard deviations in weaning weight, grades, and efficiencies.

The index may have either negative or positive values; however, by adding a sufficiently large constant positive value to the index all negative numbers may be avoided if desired.

The results of applying this index can be shown in Table 1. It will be noted that 58 per cent as much selection pressure was exerted on slaughter or final grade as if selection had been placed on that trait alone. Forty-one per cent as much selection pressure was placed

on weaning weight and 54 per cent as much pressure on efficiency of feed utilization as was possible. For these three traits the Colorado Station in using the index would increase the efficiency of selection for the three traits simultaneously approximately 43 per cent over the over-all effects of selecting for any one of the traits singly. It is interesting to note also selection on final or slaughter grade alone would give 70 per cent as much selection pressure on the traits indexed and that selection for daily gain would give 64 per cent as much selection pressure on the indexed traits as if selection had been on an index basis.

In the Colorado cow herd all heifer calves are given an opportunity to produce a calf as a two year old. Females are culled according to reproductivity and the weaning weights of calves. Previously an index was used for feeder calves, giving equal value to grade and weaning weight. However, later analysis of the data indicated that weaning grade and weight were so closely correlated that in selecting for gross income it was necessary only to use weaning weight.

Briefly summarizing then:

- (a) Selection for one trait has other than random effects on other traits.
- (b) Until the nature of these correlations is more fully understood and the over-all net income effect of selection is better understood, breeders may in changing some traits in the desired direction be automatically losing value in other traits.
- (c) Net effects of selection cannot be evaluated until there is more knowledge on the net income values of different traits and genetic correlations between traits.
- (d) While the rate of accomplishment may vary considerably, selecting on the basis of daily gain or the "rule of thumb" index herein described would appear to have similar long time effects of selecting for somewhat thin but heavy and thus "framy" weaners, heavier cattle at slaughter, which will be fast gainers and efficient in feed utilization. The over-all effect would also be for a lower grading feeder calf and perhaps a somewhat less compact finished animal. On the other hand, selecting for compact type yearlings would be selecting also for higher slaughter grades, a slight increase in weaning weight and efficiency, but for decreases in daily gain and weight at which the cattle are ready for slaughter.

A COMPARISON OF SELECTION DIFFERENTIALS FOR WEIGHT, GAIN IN WEIGHT AND CONFORMATION SCORE USING DIFFERENT METHODS OF SELECTION IN HEREFORD CATTLE

O. F. Pahnish
University of Arizona

INTRODUCTION

This is a study to compare: First, selection pressure resulting from the selection of heifer replacements, by visual observation only (at the end of the second year), to that resulting from a selection index controlled by various culling levels; second, selection pressure on four characteristics excluded from purposeful selection when 45% of the available heifers are selected on the basis of but one, a fifth, characteristic. The five characteristics considered in these comparisons are: Weaning weight, weaning score, 18 month weight, 18 month score, and gain in weight from weaning to 18 months.

Individual animals desired for replacement stock are phenotypically a combination of many characteristics that make most individual selections a compromise. Since these characteristics are not all highly correlated we do not know to what degree each one is being selected for or against in a compromise involving several different characteristics. Although correlations are useful they are only general tendencies and their reliability is reduced in small populations. Because of this it was decided to attempt the use of selection differentials for a comparison of selection pressures on these five different characteristics.

DATA AND METHODS

The data consist of weaning weights, weaning scores, 18 month weights, 18 month scores and gains from weaning to 18 months for 55 and 47 replacement heifers dropped in 1948 and 1949 respectively. The heifers were all purebred Herefords, range raised in four adjoining pastures until August first of their first year, and then run in a single pasture until 18 months of age. They were weaned at an average age of 260 days.

A 45% replacement rate was chosen since that was the actual per cent put into the herd each of two years, and is, according to Lush (1945), the average per cent of available female replacements needed to keep a beef cattle population static.

Selection differentials were calculated for each of the five characteristics and then converted to a unit basis by dividing each one by the standard deviation for that characteristic. This was done for heifers within sire groups and for the total number selected. Selection was made on the basis of 45% of each sire group and also on the basis of 45% of all heifers available.

In the absence of genetic correlations or heritability estimates on this herd, equal weight was given all characteristics when the initial index formula was devised. Various culling levels were then established to offset the compensating effect of unusually low and high values in computing the index of a given individual.

* The indexes used for replacement heifers were:

Selection index A (for replacement heifers)	Dev. from av. = $\frac{\text{weaning wt.}^1}{\text{Standard dev. of weaning wt.}}$	Dev. from av. Conf. Score ² + $\frac{(\text{wean.})}{\text{Standard dev. of conf. score (wean.)}}$	Dev. from av. + $\frac{18 \text{ mo. wt.}^3}{\text{Standard dev. of 18 mo. wt.}}$	Dev. from av. Conf. Score ² + $\frac{(18 \text{ mo.})}{\text{Standard dev. of conf. score (18 mo.)}}$
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Selection index B
(for replacement heifers) = The same basic index as index A with independent culling levels of .9 of one standard deviation below average of both weaning weight and 18 month weight being employed as well as the independent culling levels of 8.0 for both weaning and 18 month conformation score.

Selection index C
(for replacement heifers) = The same basic index as A with independent culling levels of 2/3 of one standard deviation below average of both weaning weight and 18 month weight being employed as well as the independent culling levels of 8.0 for both weaning and 18 month conformation score.

DISCUSSION AND RESULTS

Comparing selection by visual observation to selection by index A

These data show that selection pressure on conformation score was nearly equal in both cases and was not as great as the pressure on weight. There was a substantial progressive increase in the positive pressures on both weaning and 18 month weights as the method of selection changed from the visual method to selection on the basis of the highest indexes within sire groups and then to selection on the basis of the highest indexes of all heifers available.

The following table shows the summation of relative selection differentials for weaning weight, weaning score, 18 month weight and 18 month score by years and by method of selection:

** SUMMATION OF RELATIVE SELECTION DIFFERENTIALS ¹ OF FOUR ² CHARACTERISTICS		
	1948	1949
Selection by visual observation	1.84	1.27
Selection of the high 45% by index A, from each sire group	2.35	1.96
Selection of the high 45%, by index A, from all available	2.86	2.39

* ¹All weaning weights corrected for age of heifer and dam.

* ²Independent culling level used to extent that animals with score of less than 8.0 at weaning time or 18 months of age were culled.

* ³All 18 month weights corrected for age.

** ¹Actual selection differential divided by the standard deviation of that characteristic.

** ²Characteristics used in calculation of the selection index.

This shows that visual observation sacrificed much of the total advantage possible. The data indicate that this total advantage was primarily due to weaning and 18 month weights each year, thus rather important gains in selection differentials for both weaning weight and 18 month weight could be made by following the index.

Small positive selection differentials for post-weaning gains were obtained by visual selection, and little increase in those values was realized by the use of index A.

When the same intensity of selection was practiced by use of the highest indexes from all heifers available rather than from each sire group, some sire groups were represented more heavily than others. For example, the fraction saved from sire 5 in 1948 shifted from 7 out of 16 to only 2 out of the 16 available with an increased proportion coming from sire 4.

Comparing selection by index A to that by index B

Negative selection differentials for weight obtained in individual sire groups indicated a weakness in index A. Because of this weakness one standard deviation below average was used as an independent culling level for weight but was not severe enough to reject animals that were responsible for negative differentials both years. Then 0.9 of one standard deviation below average weight (at both weaning time and at 18 months of age) was employed as an independent culling level in index B along with that of 8.0 for conformation score. This method of selection eliminated all of the negative selection differentials for weight and conformation score when selecting the high 45% of all heifers available. Index B offered no consistent or material advantage over index A with regard to post-weaning gains. Using index B when selecting within sire groups did not permit the retention of 45% of the heifers by sire 5 in either 1948 or 1949. Thus a comparison of these selection differentials with those obtained by index A would not be valid.

Comparing selection by index B to that by index C

Changing the independent culling level for weight from 0.9 to 2/3 of one standard deviation and keeping the culling level of 8.0 for conformation score did not produce material changes in the selection differentials for the five characteristics. It did limit selection to less than 45% of the heifers in 1948 and 1949 when selections were made on the sire group basis.

Selection on the basis of a single characteristic

Data accumulated over a period of two years show that 18-month weight was the best of five characteristics used individually as indicators of a heifer's phenotypic merit. The following tabulations provide relative indications of the over-all phenotypic improvement of the five characteristics involved when selections were based on but one:

RELATIVE EMPHASIS TOTALED FOR FIVE TRAITS
TWO YEARS' DATA

When selecting for:	Wean Weight only	Wean Score only	18 mo. weight only	18 mo. conf. score only	Gain from wean to 18 mo. only
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Summation of
Relative emph-
asis of the 5
traits if:

Selecting the high 45% from each sire group	2.98	2.51	3.79	2.90	2.31
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Selecting the high 45% from all available	4.57	3.78	4.78	3.93	1.26
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Whether selecting a certain percentage within sire groups or a similar percentage from all heifers available, 18 month weight shows the highest positive association with the other characteristics while gain in weight from weaning time to 18 months of age shows the smallest positive association.

Negative selection differentials for post-weaning gains were obtained when selections were based upon weaning weight or conformation score at weaning time. In addition, a tendency toward negative selection differentials for weaning weight and weaning score was apparent when gain from weaning to 18 months of age determined the selections made.

SUMMARY AND CONCLUSIONS

1. Various methods of heifer selection, based upon data accumulated over a period of two years, were evaluated.
2. A selection index placing equal emphasis upon weaning weights, conformation scores at weaning time, 18 month weights and conformation scores at 18 months of age was devised.
3. Selections based upon the index, combined with various independent culling levels, were compared with selections made by visual observation only.
4. The modified index resulted in selection for heavier weaning weights and 18 month weights than did the selection by visual means. Emphasis on conformation scores was not increased materially by the use of the index method.

5. Negative selection differentials for the four traits involved in the index, and for gains from weaning time to 18 months of age, were largely eliminated when animals with one or more weights falling below 0.9 of one standard deviation, or animals with one or more conformation scores falling below 8.0, were eliminated regardless of their total index value.
6. Selection differentials for weaning weights, conformation scores at weaning time, 18 month weights, conformation scores at 18 months and gains from weaning to 18 months of age were calculated when each of the above characteristics was used as the sole basis for selection.
7. When selections were based upon single characteristics, 18 month weights showed the highest positive association with all of the other four traits considered, while gains from weaning time to 18 months of age showed the smallest positive association.
8. Selecting for high weaning weights only or solely for high conformation scores at weaning time resulted in negative selection differentials for post-weaning gains.
9. Selections based entirely upon gains from weaning to 18 months of age tended to produce negative selection differentials for weaning weights and for conformation scores at weaning time.

REFERENCE

Lush, J. L. 1945. Animal breeding plans. State College press. Ames, Iowa.

TABLE I

COMPARISON OF THREE METHODS OF HEIFER SELECTION
USING SELECTION DIFFERENTIALS OF FIVE DIFFERENT CHARACTERISTICS*
(UNIVERSITY OF ARIZONA)

Methods Compared	Advantage of High 45%, by index A, from each sire group over Visual Observation	Advantage of High 45%, by index A, from all available over Visual Observation	Advantage of High 45%, by index A, over High 45%, by index A from each sire group	Standard Deviation	1948 Heifers From All Sires							1949 Heifers From All Sires						
					Weaning Data		18 Month Data		Gain Mean. to 18 mo.	Total	Weaning Data		18 Month Data		Gain Mean. to 18 mo.	Total for Two Years		
					Wt. Cor. for age and age of dam	Conf. Score	Wt. Cor. for age	Conf. Score			Wt. Cor. for age and age of dam	Conf. Score	Wt. Cor. for age	Conf. Score				
					Means of Comparison	Actual Advantage	Relative Advantage	Actual Advantage	Relative Advantage	Wt. Cor. for age and age of dam	Conf. Score	Wt. Cor. for age	Conf. Score	Gain Mean. to 18 mo.	Total	Wt. Cor. for age and age of dam	Conf. Score	Wt. Cor. for age
					12	0	14	0	2		17	0	20	0	3			
					.25	0	.27	0	.06	.58	.33	0	.36	0	.12	.81	1.39	
					22	0	21	.1	-1		29	0	31	0	2			
					.45	0	.40	.16	-.03	.98	.56	0	.56	0	.08	1.20	2.18	
					10	0	7	.1	-3		12	0	11	0	-1			
					.20	0	.13	.16	-.10	.39	.23	0	.20	0	-.04	.39	.78	
					48.9	.51	52.1	.62	31.3		51.7	.45	55.2	.48	25.1			

*NOTE: Actual weight advantage expressed in pounds. Actual advantage in conformation score expressed in points (perfect score = 10). Relative advantages calculated by dividing each actual advantage by the standard deviation for the characteristic concerned. Heifers averaged approximately 2 years of age when selections by visual observation were made.

TABLE II

COMPARISON OF THREE METHODS OF HEIFER SELECTION
USING SELECTION DIFFERENTIALS OF FIVE CHARACTERISTICS*
(UNIVERSITY OF ARIZONA)

		1948 Heifers						1949 Heifers						
Method of Selection	Sire	Fraction saved	Weaning Data		18 mo.data			Fraction saved	Weaning Data		18 mo.data		Gain Wean to 18 mo.	
			Wt. Cor. for age and age of dam	conf. Score	Wt. Cor. for age	conf. Score	Gain Wean to 18 mo.		Wt. Cor. for age and age of dam	conf. Score	Wt. Cor. for age	conf. score		
Visual Observation	2	4/13	- 8	.5	12	.2	20							
	3	5/13	-14	.6	-16	.9	- 2							
	4	11/13	8	0	12	.1	4	8/13	10	.3	13	.2	3	
	5	5/16	24	.1	29	.3	5	3/8	- 8	.3	- 3	.6	5	
	8							3/12	-22	.3	-35	.5	-13	
	11							7/14	4	.0	13	.2	9	
	All	25/55	14	.4	15	.3	1	21/47	5	.2	6	.3	1	
High (by index A) high 5% ea. sire group	2	6/13	26	.4	33	.3	7							
	3	6/13	- 4	.6	- 5	.7	- 1							
	4	6/13	27	.1	40	.1	12	6/13	33	.3	34	.2	1	
	5	7/16	43	.3	42	.3	- 1	4/8	-10	.1	2	.5	12	
	8							5/12	25	.1	34	.3	9	
	11							6/14	31	.2	31	.3	0	
	All	25/55	26	.4	29	.3	3	21/47	22	.2	26	.3	4	
45% of all heifers	2	8/13	21	.3	23	.2	2							
	3	5/13	3	.6	- 3	.6	6							
	4	10/13	76	0	22	.1	6	9/13	16	.3	19	.2	3	
	5	2/16	76	.4	94	1.0	18	1/8	34	.4	35	.9	1	
	8							3/12	51	.0	72	.2	21	
	11							3/14	21	.2	24	.2	3	
	All	25/55	36	.4	36	.4	0	21/47	34	.2	37	.3	3	

*NOTE: Weight differentials expressed in pounds. Differentials for conformation score expressed in points (perfect score = 10). Heifers averaged approximately 2 years of age when selections by visual observation were made.

TABLE III

RELATIVE EMPHASIS ON EACH OF FIVE HELFER CHARACTERISTICS
WHEN SELECTIONS WERE BASED ON BUT ONE*
(UNIVERSITY OF ARIZONA)

		1948 Heifers From All Sires					1949 Heifers From All Sires							
		Relative Emphasis On:					Relative Emphasis On:							
Selection on The Basis of:		Wean. Wt.	Wean. Conf. Score	18 mo. Wt.	18 mo. Conf. Score	Gain from Wean. to 18 mo.	Total	Wean. Wt.	Wean. Conf. Score	18 mo. Wt.	18 mo. Conf. Score	Gain from Wean. to 18 mo.	Total	Total For two Years
High	Weaning Wt. Only	.70	.39	.61	0	-.06	1.64	.75	0	.67	0	-.08	1.34	2.98
45%	Wean. Conf. Score Only	.29	.98	.23	.48	-.06	1.92	-.02	.67	-.16	.42	-.32	.59	2.51
From Each	18 Mo. Wt. Only	.51	.20	.75	.16	.45	2.07	.62	0	.74	0	.36	1.72	3.79
Sire	18 Mo. Conf. Score Only	.06	.59	.21	.65	.26	1.77	-.08	.22	.0	.83	.16	1.13	2.90
Group	Gain From Weaning to 18 Mo.	.02	0	.46	.32	.73	1.53	-.25	-.22	.16	.21	.88	.78	2.31
High	Weaning Wt. Only	.86	.78	.69	.32	-.19	2.46	.93	.22	.83	.21	-.08	2.11	4.57
45%	Wean. Conf. Score Only	.43	1.18	.29	.48	-.19	2.19	.25	.89	.11	.62	-.28	1.59	3.78
From All	18 Mo. Wt. Only	.72	.39	.88	.16	.35	2.50	.83	0	.92	.21	.32	2.28	4.78
Avail- able	18 Mo. Conf. Score Only	.47	.78	.42	.81	-.03	2.45	-.04	.44	.05	.83	.20	1.48	3.93
	Gain From Weaning to 18 Mo.	-.10	-.20	.42	0	.86	.98	-.29	-.44	.13	0	.88	.28	1.26
Standard Deviation		48.9	.51	52.1	.62	31.3		51.7	.45	55.2	.48	25.1		

*NOTE: Relative emphasis calculated by dividing the selection differential by the standard deviation for the characteristic concerned. Weaning weight was corrected for age and for age of dam; 18 mo. wt. was corrected for age only.

SELECTION OF BEEF CATTLE
Ralph Bogart
Oregon State College

The Oregon Station has selected on the basis of (1) gains from birth to weaning, (2) gains from 500 to 800 pounds of weight, (3) feed efficiency from 500 to 800 pounds of weight, and (4) score at 800 pounds with equal emphasis being placed upon each.

The index used is

$$I = \frac{\text{BW gains}}{\sigma \text{ BW gains}} + \frac{\text{Feedlot gain}}{\sigma \text{ Feedlot gain}} + \frac{\text{Efficiency}}{\sigma \text{ Efficiency}}$$

$$\bullet \frac{\text{Score}}{\sigma \text{ Score}}$$

Where

I = index

BW gains = deviation from mean of gains from birth to weaning.

Feedlot gain = deviation from mean in gain from 500 to 800 pounds.

Feed efficiency = deviation from mean for gain/feed during period from 500 to 800 pounds.

Score = deviation from mean on visual score (basis of 100) at 800 pounds

σ = standard deviation.

This index was established before heritabilities were determined on the herd. Since there is a difference due to year and sex in one or more of the traits included in the index, it becomes necessary to determine a mean for each trait each year by sex in order to make proper use of the index.

Data have been taken on numerous traits, however, so that studies could be made on what has been happening.

A study was made to see what would have happened to each of the other three characteristics if selections were made only for one of the four characteristics keeping 50 per cent of the heifers and 10 per cent of the bulls.

Selecting for rate of gains from birth to weaning resulted in no effect on score at 800 pounds but it did favor the slower gaining and less efficient feedlot performers.

Selecting for rate of gain from 500 to 800 pounds was very effective for selecting the most efficient animals but tended to favor the calves that had not done so well before weaning. It had no effect on score.

Selecting for efficiency alone favored the faster gaining calves in the feedlot, the slower gainers during the suckling period, and had no effect on score at 800 pounds.

Selecting for score at 800 pounds had no effect on rate of gain and efficiency in the feedlot but favored the calves making more rapid gains during the suckling period. The score at weaning was positively associated with score at 800 pounds but negatively associated with rate of gain and feed efficiency after weaning.

Studies that are now being made indicate that heritabilities in the Hereford cattle at Oregon State College differ for some traits from what has been reported by others in other herds.

Score at 800 pounds is estimated at approximately 25 per cent varying from 19 to 30 per cent depending upon the method of calculation.

By an analysis of sire effect on the ability of cows to wean heavy calves it was estimated that gain from birth to weaning is approximately 40 per cent heritable. This method combines the calf's growth tendencies with his dam's milking ability and is admittedly not an accurate estimate of the heritability of gains during the suckling period.

Heritability of rate of gain and efficiency in the feedlot agree with the later estimates of the U. S. Range Livestock Station.

When one considers these heritability estimates and the economic importance of the four characteristics it is obvious that giving score at 800 pounds equal importance to the other three traits is not justified.

GENERAL CONCLUSIONS

1. It is evident that selecting for one characteristic only does not permit random fluctuations of the other characteristics.

2. There is no one characteristic for which we can select and secure improvement in all the productive traits.

3. Since it is essential to select for all the productive characteristics concurrently, the index method appears more logical because a minimum culling level for several characteristics must be set so low as to be of little effect or, if it is set high, it will eliminate some of the best genetic material for the other characteristics.

4. A survey of all the stations indicates a need for more data before an index can be established on the basis of heritability, economic importance, and genetic correlations.

5. Each station will need to establish its own index or modify any that is established to fit the situation at the station.

6. Evidence is accumulating which indicates a selective advantage for certain undesirable and abnormal traits. A strict culling program for eliminating such characters may be necessary in addition to selecting on an index basis for the productive characteristics.

The Chairman called upon Dr. Roubicek to review the report of the Carcass Committee, copies of which had previously been sent to each Technical Committee member. The following is a copy of this Committee Report:

SUGGESTED PROCEDURES FOR BEEF CATTLE CARCASS EVALUATION

C. B. Roubicek
University of Wyoming

The Reciprocal Meat Conference, sponsored by the National Livestock and Meat Board, is attempting to standardize slaughter and evaluation procedures among the various Stations. At the last meeting, held in June, 1951, various procedures were discussed by the group but final action on standardization was scheduled for the 1952 meeting. It is suggested that final action on carcass evaluation be delayed by this group until after the Reciprocal Meat Conference has completed their study.

In addition to the Reciprocal Meat Conference the Ontario Advanced Registry Policy for Beef Cattle as well as the various Regional Beef Breeding Laboratories are investigating various phases of carcass evaluation. This report includes some of the more pertinent suggestions of these various sources.

PRE-SLAUGHTER

1. Time of Slaughter:

Animals should be slaughtered for carcass evaluation when the live-animal grade reaches the middle of the U.S. Choice Grade (revised U.S.D.A. standard). The possibility of using the antipyrine method of Kraybill et al (Jour. Applied Physiology 3:681-689, 1951) to determine the relative condition of the animal should be considered.

2. Live Animal Measurements:

Measurements taken prior to slaughter to include the following:

- a. Heart girth
- b. Height of withers
- c. Depth of chest
- d. Width of chest
- e. Circumference of middle
- f. Circumference at rear flank
- g. Circumference of shin-bone
- h. Circumference of round

All measurements of live animal as well as the various carcass measurements to be taken in millimeters.

3. Live Animal Scores:

A system for evaluating the various conformation points of the live animal to be used in conjunction with carcass analysis. This score system must conform to the recommendations of the Selection Committee.

4. Pre-slaughter Shrink:

All animals to be confined 24 hours prior to slaughter. The animals should be held without feed but with water available.

SLAUGHTER DATA

1. Empty Body Weight:

The digestive tract is weighed before and after removing their contents. The Experimental Beef Slaughter Record indicates the various weights to be taken.

2. Hot Dressed Weight:

Weigh the carcass immediately after evisceration and before the carcass is washed and shrouded.

3. Chilled Carcass Weight:

Weight to be taken 48 hours after chilling. This weight serves as the standard for determining the relative yields of the various carcass cuts.

4. Chilled Carcass Grade:

The carcass is to be graded to the nearest 1/3 of a grade (U.S.D.A. Revised standard).

5. Beef Carcass Measurements:

The following recommended procedure was submitted to the Reciprocal Meat Conference for their consideration.

The amount of equipment necessary to make carcass measurements is rather limited. A flexible steel tape is used when making the majority of the measurements. It should be six feet long, have a white background with black numerals and be calibrated in millimeters. A pair of eighteen or twenty inch outside measuring calipers are needed for the width measurements. A rigid millimeter rule is needed to be used in conjunction with the calipers. For making the eye muscle measurements a compensating polar planimeter, protractor, and a transparent millimeter rule are needed. A platform or step-ladder must be provided to stand on. Other incidentals include skewers or shroud pins, tracing paper, and an eight by eleven inch piece of heavy wax impregnated cardboard to be used for a square.

Unribbed Carcass Side

(1) Length of body - The length of body is determined by measuring from the anterior edge of the 1st thoracic vertebra to the anterior edge (lowest point) of the aitch bone.

(2) Length of hind leg - The length of hind leg is measured from the anterior edge (lowest point) of the aitch bone to the highest point of the hock joint. This is at the smooth joint where the foot and leg have been removed (between first tarsal and the large metatarsal bones).

(3) Total length of carcass - The total carcass length is the sum of the length of body and length of hind leg measurements.

(4) Circumference of round - Measuring the circumference of the round is the most difficult of all the measurements but becomes fairly simple with a little practice. The circumference of the round is measured perpendicular to the length of the hind leg measurement sixty per cent of the distance from the hock to the anterior edge of the aitch bone. The procedure is as follows: establish a straight line between the two points used when determining the length of hind legs with skewers or shroud pins. Place one skewer (a) exactly sixty per cent of the distance from the hock joint to the anterior edge of the aitch bone on the previously established line. From this point place a skewer (b) along a line perpendicular to the previously established line on the anterior side of the round and another (c) in the same manner on the posterior side of the round. This establishes the three necessary guides (a, b, and c). An 8 x 11 inch piece of wax impregnated cardboard may be used when placing these skewers perpendicular to the length of leg. Measure the circumference by placing a steel tape below these three mentioned skewers and taking a reading after making sure the tape is taut and touching all three of the skewers.

(5) Depth of body - The depth of body is measured from the dorsal side of the spinal canal at the 5th thoracic vertebra to the ventral side of the sternum (breast bone) with the tape being held parallel to the floor. Some work has been done using the 7th thoracic vertebra as the origin of the measurement and it was often found impossible to hold the tape parallel with the floor due to the curvature of the ribs causing the sternum to end or stop anterior to this point.

(6) Length of loin - Measure the length of loin from the anterior edge of the aitch bone to the middle of the 12th thoracic vertebra. The latter point is the theoretical place where the loin and rib are separated when the carcass is ribbed and may be located by counting down seven and one-half vertebrae from the rise in the backbone.

(7) Width of shoulder - Measure the width of shoulder from inside of the carcass at the first thoracic vertebra to the outside of the shoulder with 18 or 20 inch outside measuring calipers. Hold the axis of the calipers in a median plane to the carcass and parallel to the floor. The sum of the measurements of the right and left side is used. This eliminates any source of error that might be due to uneven splitting of the backbone.

(8) Width of round - Determine the width of the round by measuring with the calipers from inside the carcass at the highest point of the aitch bone to the outside of the round. Hold the axis of the calipers in a median plane to the carcass and parallel to the floor. The sum of the measurements of the right and left sides is used.

Ribbed Carcass Side

The measurements taken from the ribbed carcass side are designed to characterize the eye muscle (*longissimus dorsi*) and the adjacent external fat. The measurements are customarily taken from a tracing of this portion of the carcass because it is difficult to take the measurements directly from the rib cut. The tracings also permit making the

measurements at one's leisure. The tracing should be made on a transparent, non-absorbent paper which has a suitable surface for writing. PTM-173 tracing paper meets these specifications. A sharp pointed lead pencil should be used when making the tracing. The eye muscle and the external fat covering are traced as indicated.

(1) Area of eye muscle - For this measurement it is necessary to follow the outline of the eye muscle with a compensating polar planimeter.

(2) Length of eye muscle - This is the distance of the long axis of the eye muscle.

(3) Width of eye muscle - The average of three measurements is taken for the width of eye muscle. The first is made perpendicular to the line used in determining the length of the eye muscle at a point one-half the length of the eye. The second is parallel to the first at a point one-fourth the length of the eye muscle from the ventral edge of the eye muscle. The third is parallel to the first at a point one-fourth the length of the eye muscle from the dorsal edge of the eye muscle.

(4) Width of fat - Measure from the outside of the fat where the surface of the fat is perpendicular to the three points on the outside of the eye muscle that were used determining the width of eye measurement. The average of the three measurements is used.

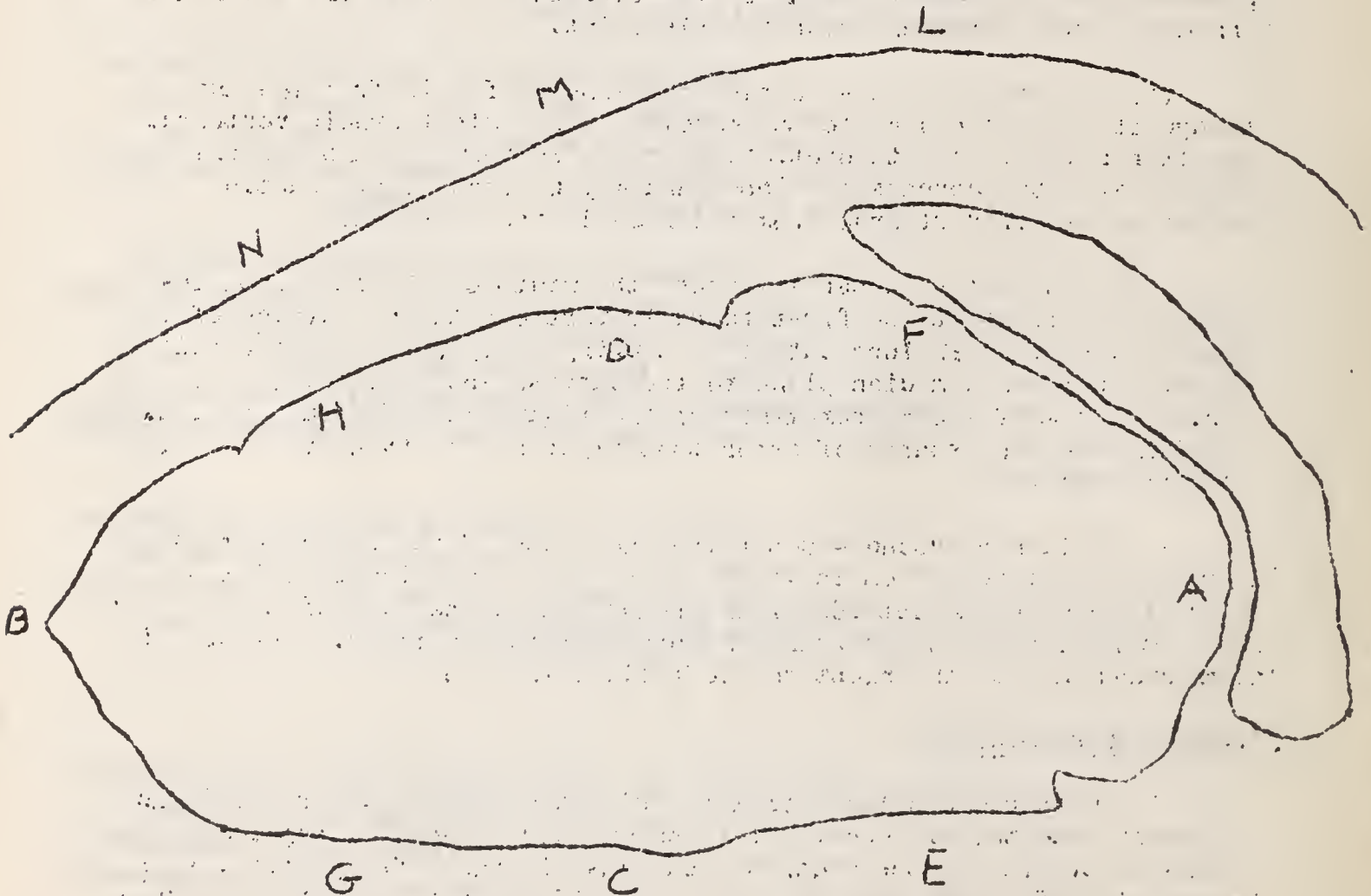


Diagram of rib cut showing eye muscle and external fat.

The NC-1 Committee (1951) suggests the following split carcass measurements which follow the recommendations of Hankins.

- a. Length of carcass
- b. Length of leg
- c. Width through shoulders
- d. Width through rounds
- e. Circumference of rounds
- f. Area of eye muscle and fat at the 11th rib, based on tracing.

6. Yield of Wholesale Cuts:

The method of cutting is described in U.S.D.A. Tech. Bull. 926. The carcass cuts considered are:

- a. Whole loin (stripped)
- b. Rib
- c. Round (rump and shank on)
- d. Chuck
- e. Plate
- f. Flank
- g. Brisket
- h. Shank
- i. Kidney
- j. Fat trimmings

All weights to be recorded in tenths and hundredths of a pound.

7. Relative Quality of the Carcass Cuts:

The Ontario Advanced Policy Committee (1951) has recommended factors and a score of points for beef carcass evaluation as follows:

1. Balance.....	15 points
2. Blockiness.....	25 points
3. Fullness of Meat.....	25 points
4. Portion of fat to lean.....	20 points
5. Marbling.....	5 points
6. Colour of fat.....	5 points
7. Colour and texture of meat.....	5 points
	100 points

Explanation of Factors Suggested:

1. Balance - is relationship of weight in hind and fore quarters
2. Blockiness or compactness is indicated by the amount of fleshing on the hind leg (short hip) in relationship to the length of the hind leg, and in length and fleshing of front leg (shank).

Measurements to Gauge Blockiness:

Hind Leg

- (a) Distance from flat surface of hock joint (standard killing practice) to lower side of H bone knob.

- (b) Width of short hip, one-third of distance from H bone to flat end. Measurements to be on a line at right angles to tibia - H bone line.

Front Leg

- (a) Distance from ulna bone end (elbow) tip to knee cut.
(b) Circumference of arm one-third distance from knee cut to elbow.

Figures for scoring arrived at by:

Subtract (b) measurement from (a) measurement hind leg.

Subtract (b) measurement from (a) measurement of front leg.

3. Fullness of Meat: Total area of eye or longissimus dorsi muscle in relation to weight of carcass. Using Protectoid tracing paper, trace the size of longissimus dorsi muscle and all other lean meat cross-sections, and using a planimeter ascertain (a) area of longissimus dorsi muscle (b) area of all the muscle cross-sections.

4. Proportion of Fat to Lean: Total area of fat in cross-section in relation to weight of carcass. Trace all area of rib cross-section back to first rib cartilage. Using planimeter, measure area of all fat in cross-section. Subtract area of lean from total area to get area of fat in square inches.

Note: Ribbing is to be done between 11th and 12th ribs, hugging 11th rib to chine and then cutting through longissimus dorsi muscle at as nearly right angles to carcass length as possible.

5. Marbling is an eye factor, not a measurement factor, and indicates the amount of infiltration of fat into the lean muscle area.

6. Colour of Fat is also an eye factor.

7. Colour and Texture of Meat: This eye factor has to do with dark cutting meat and coarse stringy meat.

Note: (a) The three eye factors are not considered to be as important as the others but are too important to ignore entirely.

(b) Carcasses are to be ribbed, measured and weighed 48 hours after slaughter.

(c) Colour of fat and colour of lean to be measured by colour charts.

The NC-1 Committee has set up recommended quality evaluation as follows:

The 7th to the 11th rib cut from the right side will be used for evaluating composition, color and tenderness of the cooked meat as follows:

A. Composition and color of the 9-11 rib cut will be evaluated from a weighted average of scores for:

(1) Marbling of the rib eye muscle scored 1 to 9, based on ether extract content of eye muscle. A photographic reference standard corresponding to the middle of each of the 9 grades will be developed for use when ether extract cannot be obtained.

(2) Composition of the rib cut scored 1 to 9, based on the ether extract content of the edible portion. A photographic reference standard, with corresponding ranges in separable fat and ether extract, is being prepared for use when the rib cut cannot be separated or extracted. When animals are slaughtered at finish corresponding to middle U.S. Choice, it is not anticipated that any carcasses will be above optimum in fat content.

(3) Color Standard A, by the U.S.D.A., manufactured by Munsell Color Company, Baltimore, Maryland, will be used to characterize pigmentation of the cut after exposure to air for a standard period of 30 minutes.

The order of observation on the rib cut would be: first visual scoring for muscling of eye, composition of entire edible rib and color; then physical separation of fat and lean; and finally, ether extraction of samples from the eye muscle and the remaining edible portion. The latter would permit estimation of total fat content of the carcass.

B. Evaluation of tenderness of cooked 7-8 rib. After chilling 10 days, the 7-8 rib will be roasted according to the standard procedure given by the Blue Book of the National Live Stock and Meat Board. Tenderness of the cooked meat will then be evaluated by the Warner-Bratzler Shear Test. The possibility of using only the 8th rib for a standard broiling test of the steak is under investigation, but it seemed doubtful that suitable equipment for standardized broiling would be available at many of the stations.

8. Final Score:

A final carcass score to be based on:

- a. Live weight. (according to empty body weight)
- b. Relative value of the carcass cuts (using Loin as a standard.)
- c. Quality evaluation of the carcass cuts.

EXPERIMENTAL BEEF SLAUGHTER RECORD

Date and time of Slaughter _____

Identification _____ Wt-End of Feeding _____ (lbs) Time taken off feed _____

Sex - - - - - _____ Live Wt at Slaughter _____ (lbs) Holding time (hrs) _____

Breed - - - - - _____ Holding shrink _____ (lbs)

Age (if known) _____ Holding shrink _____ (%)

Live Grade - _____ Price _____ Cost _____ Value _____

Blood - - - - - (lbs) Liver _____ (lbs)

Head _____ (lbs) Heart _____ (lbs)

Hide _____ (lbs) Tongue _____ (lbs)

Frontshanks and feet _____ (lbs) Sweetbreads _____ (lbs)

Rearshanks and feet _____ (lbs) Cheek Meat _____ (lbs)

Caul Fat _____ (lbs) Tail _____ (lbs)

Ruffle Fat _____ (lbs) Carcass Number _____

Paunch Weights _____ (lbs) Hot Carcass Weight _____ (lbs)

Empty Weights _____ (lbs) Chilled Carcass Weight (24 Hrs) _____ (lbs)

Intestine Weights _____ (lbs)

Empty Weights _____ (lbs) Chilled Carcass Weight (48 Hrs) _____ (lbs)

Totals _____ (lbs)

Contents _____ (lbs) Shrink _____ (lbs) _____ (%)

Pluck _____ Dressing Percentage _____

Bladder _____ Carcass Grade _____

Empty " _____ Color Fat _____

Wt. of Urine _____ Carcass Cost _____

Miscellaneous _____

Comments:

Mr. A. D. Brownfield of Deming, New Mexico, was introduced. The title of his talk was, "A Stockman's Opinion of What a Beef Cattle Breeding Project Should Accomplish." Mr. Brownfield is a past president of the American National Cattlemen's Association, and of the New Mexico Cattle Growers Association. In a few well chosen words he emphasized the need for cattle that are adapted to the environment in which they will be raised. He stressed the need for size in range cattle and for cows that will bring in a good calf at weaning time.

Dr. Sierk summarized the morning discussions, pointing out that the objectives of the W-1 project are very similar to the factors brought out by Mr. Brownfield. He defined research and commented on how difficult it is for most of us to "revise accepted conclusions in the light of newly discovered facts."

Dr. Hilston announced that the group would meet at 1:00 P.M. at the Beef Cattle Barn to inspect the Registered Hereford herd and hear a discussion of the breeding program in the New Mexico Station herd by Prof. Knox.

Meeting adjourned at 11:20 A.M.

The group gathered at the Beef Cattle Barn at 1:00 P.M. Prof. Knox had the herd grouped by lines according to the revision of the New Mexico project. These lines include one selected for soundness and longevity, one for suckling ability and heavy calves, and one selected for weight and grade. He discussed the breeding of the cattle as to blood lines and distributed mimeograph sheets with the names and ages of the cows in each line and a record of their production. The individual bull feeding facilities were inspected, following which Dr. Gregory gave a demonstration of his method of gathering data for the identification of animals heterozygous for one of the dwarf genes. At the conclusion of this demonstration the group of ranchers cooperating with the New Mexico station who had been participating in the meeting separated from the group and the Technical Committee reconvened in the Sun Room at 3:00 P.M.

Dr. Hilston appointed a Resolutions Committee consisting of Mr. Willson, Dr. Bogart, and Mr. Knox.

Dr. Hilston called for a review of the report of the Committee on Feed Utilization. Copies of this report had been sent to each Technical Committee member. In the absence of Prof. Bennett, the report was reviewed by Dr. Keith. Following is the text of the report:

REPORT OF THE SUB-COMMITTEE ON FEED UTILIZATION
OF THE TECHNICAL COMMITTEE OF PROJECT W-1

James A. Bennett, Chairman; T. B. Keith, C. E. Lindley

In order to locate the animals that are genetically superior for efficiency of gains, feed utilization must be properly and accurately measured. The sub-committee feels that topics associated with feed utilization can be grouped under the following two headings:

I. Major factors affecting feed utilization

- a. Size of animal and age of animal
- b. Type of ration
- c. Rate of feeding
- d. Condition of animal and composition of gains
- e. Sex

II. Means of expressing efficiency of feed utilization

- a. Total digestible nutrients
- b. Metabolizable energy
- c. Net energy
- d. Feed required per 100 pounds gain

FACTORS AFFECTING FEED UTILIZATION

Size of animals and age of animals

Numerous tests with a wide variety of species have demonstrated that as animals grow larger and become older the efficiency with which feed is utilized decreases. Knapp and Baker (1944) concluded in beef cattle that comparisons of gross efficiency should only be made between animals of similar size. It would seem advisable to feed animals of comparable ages through approximately the same weight range when testing for efficiency of gains. When this is not practical statistical adjustment is advisable. Fitting the efficiency measures to a line by the least squares method appears to be a satisfactory method for comparing animals of different sizes. Hankins and Titus (1939) illustrates a method with poultry that could be adapted to cattle.

Type of ration

The type and composition of the ration influences the efficiency of feed utilization. This is particularly true in regard to the roughage-concentrate ratio.

Ratios of concentrate to roughage consumed by individuals may cause a greater difference in rate of gain, feed efficiency (regardless of the method of expressing it) than the actual inherent difference of the physiological functions of the animal being measured.

Average differences in the performance of groups of steer calves fed various ratios of concentrate to alfalfa hay.

Ratio of Concentrate to Hay	Av. Daily Gain	Feed required for each 100 pounds gain	*Est. net energy required for each pound gain
1:3	1:52	933	1693
1:2	1:88	817	1621
1:1	1:82	852	2446
2:1	2:11	742	1522
3:1	1:96	722	2457
4:1	1:96	716	2391

* above maintenance

The data shown in the above table clearly demonstrates the importance of controlling the ratios.

Range in feed required for each 100 pounds gain for the various ratios with 10 animals in a group.

Ratio of Concentrate to Hay	Range in Feed Required for each 100 pounds of gain
1:3	831-968
1:2	690-888
1:1	761-951
2:1	537-819
3:1	661-789
4:1	616-813

Consideration should be given to feed combination in comparing the same ratio used by two different stations. For example, the Gilliam County Beef Improvement Association of Condon, Oregon, used grain to hay ration. The feed required for each one hundred pounds of gain varied from 511 to 744 with an average of 609. The ratio used was as follows:

Calves weighing less than 600 lbs.	1 grain to 3 hay
Calves weighing 600 to 700 lbs.	1 grain to 2 hay
Calves weighing over 700 lbs.	1 grain to 1 hay

The average ratio for the group was less than 1:1.

The results of the work at the Caldwell Branch Station with ratios of concentrate to hay of 1:1 gave feed requirements for 100 pounds of gain for bulls with a range of 747 to 1115 and an average of 887 pounds. These bulls received a different ration of concentrate than those of Gilliam County, Oregon.

However, the difference in environment of the two stations may be contributing to a difference in efficiency.

Rate of feeding

In order to determine if animals differ in their genetical make-up for efficiency of gains the animals must be fed at a sufficiently high level to allow the genes to express themselves. Animals rating high in efficiency are invariably animals that eat a large amount in excess of maintenance requirements. To identify efficient animals it will be necessary to feed well above maintenance level. Full-feeding of a suitable ration would, undoubtedly, be most desirable where possible.

Condition of animal and composition of gains

Animals that are in thin condition at the start of the feeding trial should be expected to put on gains with less feed than fat animals because the gains contain less fat. It has been adequately determined that many times more energy is needed to store a pound of fat than a pound of other body tissue. Brody (1945) suggests that when the associated water is considered the difference may be as great as 8:1. This would

indicate that the condition (percentage fat) of each animal at the beginning and end of the test period is important.

Numerous workers have attempted to devise methods of determining composition of live animals. Some success has been obtained by determining specific gravity but the method of determination is difficult to apply to beef cattle. A recent study at the Utah station Transtrum (1951) showed that body measurements were not a sufficiently accurate means of determining body composition. A recent method described by Kraybull, et al (1950) appears to be a satisfactory, accurate method for estimating body fat in cattle. This method should be given full consideration by all stations that are testing cattle for rate and efficiency of gains.

Sex

Practically all the cooperation stations on project W-1 report that bulls gain faster and more efficiently than heifers when efficiency is measured as gross efficiency. Much of this difference undoubtedly arises from differences in composition of gains. However, until this point is more clearly understood the sex of the animal should be considered when reporting efficiency.

MEANS OF EXPRESSING EFFICIENCY OF FEED UTILIZATION

Total digestible nutrients

There are several points that should be kept in mind concerning T.D.N. values. First of these is that they are average values. Four factors that affect these values are: 1. level of intake, 2. species, 3. age of animal, 4. associative effects of feeds. In general most T.D.N. values, metabolizable energy, and net energy values have been obtained on a low level of feed intake. Schneider in a recent report showed that only 27.5 per cent of the digestion trials with ruminants were conducted with cattle.

When the variations contributed by the variation in feeds between different areas and different years are considered in addition to the above factors, it can readily be seen that an expression of feed utilization in terms of T.D.N. can not be highly accurate for comparing individuals.

Metabolizable energy

Very few metabolizable energy values are available at present. Such values may be calculated from T.D.N. values but these would only be average values and thus limited in application.

Net energy

Actual determination of net energy has been made on only a very few feeds. These again could be calculated from T.D.N. but would then have the same limitations as T.D.N. and metabolizable energy.

Feed required for 100 pounds gain

There are two common methods of expressing the amount of feed required for each 100 pounds gain in weight. One method is to combine

the weights of all feeds both concentrates and roughages, into a single total regardless of the combinations of feeds, percentage roughage or quality of feeds. The other method is to list the concentrates and roughages as separate items.

The committee feels that for most cases the first method is most desirable. Some adjustments may have to be made when comparing animals that have been on widely different types of rations, but to date no satisfactory method of accurately adjusting for this has been developed.

SUMMARY

The sub-committee on feed utilization recommend that in testing and comparing beef cattle for efficiency of gains full consideration should be given to the following points.

1. Test animals should be of approximately the same size and age. When differences exist for size statistical adjustments will improve accuracy.
2. Type of ration, particularly the ratio of concentrates to roughage, will markedly influence efficiency values.
3. Animals should be liberally fed to allow genetic differences to express themselves fully.
4. The composition of the gains should be ascertained. The use of antipyrine for this purpose appears to be a promising method.
5. Sex has a large influence on gross efficiency and adjustments must be made when comparing animals of opposite sex.
6. Expressing efficiency of feed utilization in terms of pounds of feed per 100 pounds of gain is recommended.

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A good deal of discussion followed the review of this report. It is quite obvious that we are not yet at the point where we are justified in making comparisons in performance, particularly feed requirements, between stations. It would appear, also, that we are far from ready to make recommendations as to the most desirable method of expressing feed requirements or conditions for conducting feeding tests such as preparation of feeds, manner of feeding, etc.

Dr. Hilston asked for a review of the report of the Record Forms Committee, copies of which had been sent to all Technical Committee members. Mr. Willson reported that he had been unable to get the Committee together and so had taken it upon himself to make reproductions of the Committee report on records and forms for the North Central Region. He further reported that after arriving in Las Cruces, he had enlisted the services of Dr. Gregory and Dr. Kidwell and they had prepared a supplement to the original report. Copies of the supplement were distributed which included forms from the California, Montana, and Miles City stations. Following is a statement from the supplemental report:

"It is the feeling of this Committee that no attempt be made to standardize all record forms as their convenient use depends to a large degree on the situation and personal preferences of the workers in the various cooperating states. However, we do feel that an attempt should be made to standardize certain phases of the data to be recorded.

"The attached forms are presented for your consideration along with the North Central Report which was reproduced and mailed to you earlier. Inasmuch as the personnel of this Committee has completely changed in the last few weeks, it has been impossible for the Committee to get together for more than one meeting. However, we do feel that considerable study should be made and recommendations presented at a later date.

P. W. Gregory
J. F. Kidwell
F. S. Willson."

Dr. Hilston asked for the wishes of the Committee relative to the four committee reports, and if it was the desire of the Technical Committee to continue these sub-committees. Included in the discussion was the matter of pooling data, standardization of records, and system of scoring. Dr. Bogart moved the appointment of a committee to study the possibilities of pooling data. Seconded by Dr. Keith. Motion carried. Dr. Gregory suggested a committee be appointed to study qualitative inheritance. There was discussion relative to the carcass, selection, and record forms committees. Motion by Dr. Kidwell, seconded by Dr. Gregory, that the following committees be appointed--Qualitative Inheritance, Carcass Evaluation, Selection and Record Forms, and Feed Utilization. Motion carried.

Dr. Hilston announced the Committee would meet again at 7:30 P.M., for a discussion of dwarfism by Dr. Gregory.

Meeting adjourned at 6:15 P.M.

Meeting reconvened at 7:30 P.M. Dr. Gregory reviewed the dwarf problem, telling how he became interested in it, the approach that the California station is taking in the study of the problem, some of the results to date, and he outlined the needs for the solution of the problem. A series of slides was shown illustrating methods and results.

The meeting adjourned at 9:30 P.M.

October 10

Meeting called to order by the Chairman, Dr. Hilston, at 8:00 A.M. The Chairman announced the following committee appointments:

1. Possibilities of Pooling Data

Ralph Bogart, Chairman
C. F. Sierk

2. Qualitative Inheritance

P. W. Gregory, Chairman
J. F. Kidwell

3. Carcass Evaluation

C. B. Roubicek, Chairman
E. P. Margerum, Jr.

4. Selection and Record Forms

F. S. Willson, Chairman
Ralph Durham
C. E. Safley
J. E. Ingalls
H. H. Stonaker

5. Feed Utilization

J. A. Bennett, Chairman
T. B. Keith
M. W. Galgan

The Chairman called for individual station reports. He suggested that since copies of station reports had been distributed to all Technical Committee members the report be confined to questions concerning the report and any additions since the annual report had been prepared. He asked that the stations respond alphabetically. Floyd Pahnish stated that there were no additions to the Arizona report. P. W. Gregory reported the intent of the California station to establish a test herd to study the inheritance of dwarfism. He stated that nearly all the data up to the present time had been obtained from private breeders. This cooperative approach will be continued, but it is now necessary to make some critical matings to obtain specific information. He urged cooperating states to continue to gather data in their own and breeders' herds and pledged his assistance to the extent time and finances would permit.

Motion by Pahnish, seconded by Willson, that the California station be encouraged to establish a test herd. Motion carried unanimously. Ingalls reported no additions to the Colorado report. Keith reported additions to facilities at Idaho. Willson reported no additions to the Montana report. He raised a question relative to bull testing and said the Montana station was unable to feed all the bulls breeders wished to enter. There was a general discussion of this topic. It was recommended that all stations study the various approaches to this problem. Superintendent Quesenberry distributed copies of the U. S. Range Livestock Experiment Station report and discussed it briefly. Kidwell had no additions to the Nevada report. Durham stated that the New Mexico report had been prepared by Dr. Koger and Prof. Knox. He referred to the review of the New Mexico project by Prof. Knox the preceding afternoon. Bogart reported no additions to the Oregon report. Bennett elaborated on the preliminary trial at Utah in which a completely pelleted ration was fed. He stated the Utah station plans to continue this investigation. Galgan reported no additions to the Washington report. He extended greetings to the Committee on behalf of Dr. Ensminger. Roubicek reported no additions to the Wyoming report. He spoke briefly on the matter of distribution of information within and between regions. Motion by Roubicek that the Regional Coordinator compile a list of Technical Committee members in all regions and that all stations promptly send reprints and bulletins to all Technical Committee members. Seconded by Gregory. Motion carried.

Dr. Hilston called upon Dr. Sierk for an over-all review of W-1. His report follows:

STATUS OF W-1 AS OF July 1, 1951

C. F. Sierk, Western Regional Coordinator

- 11 states actively cooperating (Hawaii to become active this year)
- 55 technical personnel
- 100+ including non-technical and extension personnel
- 2,980 head registered cattle
- 61 lines or herds
 - 52 Hereford (47 horned and 5 polled)
 - 4 Angus
 - 4 Shorthorn
 - 1 Angus-Hereford
- 1,344 head in grade test herds
- 4,000 (approximately) head of cattle in cooperators' herds

Total investment in the region in cattle and facilities, 3-1/3 million dollars

Total expenditures for the year ending June 30, 1951

by States from all sources	\$362,000
by Bureau of Animal Industry	89,000

This is a rather imposing array of statistics. A perfectly logical question for someone to ask is, what has been accomplished? To me the most significant accomplishment is the fact that these resources, just reviewed, have been willingly committed to study cooperatively the important factors

in economical beef production, and systems of breeding which will result in improvement of beef cattle. An indication of how this project is viewed by others is the fact that it was selected as an example of the regional approach to a problem to be reviewed before the various commodity chairmen recently in Washington. Dr. Clark will have more to say on this.

It becomes quite obvious that a well coordinated cooperative approach to such a problem as this is the most efficient if one attempts to review the problem in all of its ramifications. And when we speak of cooperation we should be thinking not only at the state level but within an institution, because it is becoming increasingly clear that there is ample opportunity for the geneticist, the biometrician, the physiologist, the nutritionist, the animal husbandman, the meats specialist, the pathologist, and the private breeder, be he a purebred or commercial operator, to all make a real contribution. Cooperation with B.A.I. through its field stations and coordinating personnel was provided for in the R.M.A.

It is unnecessary for me to review in detail the accomplishments at the individual stations since they are to be found in the annual reports, copies of which you all have received. I stated earlier in this report that all eleven states in the region have active projects contributing to W-1, and that the Hawaii station has an approved project on file which should become active this year. During the past year, five stations have either revised or expanded contributing projects. While it may be anticipated that there will be further revisions and additions in the future, the nature of breeding experiments is such that a certain period of time must elapse before progress can be accurately determined.

Certainly in beef cattle this time factor should be a minimum of eight to ten years, which would permit the turning of two generations.

There are those who clamor for results. I am sure that those of us close to the project are as anxious to know what is happening in these various lines and herds as those on the outside. Our anxiety, however, must be tempered with judgment, and it must be realized that in many respects this work started from "scratch". There was not a backlog of basic information upon which to draw. In fact, in many respects our research to date has been concerned with testing accepted hypotheses, many of which, as you well know, have been found wanting. The foregoing is not intended in any way to excuse or condone the accumulation of unanalyzed data. It is my opinion that the problem of data analysis, already present at some locations, will very soon be apparent at all stations. Our sub-committee reports definitely indicate to me the need for further study of these topics as well as others yet unexplored.

I view the project at the moment as being in a very healthy condition. It may be likened to the well-built freshman student reporting to the football coaching staff at one of our institutions which has recently undergone a "de-emphasis study". Its future is bright and the fans, represented by the industry, are quite willing to place their side bets that it will come through and produce.

Dr. Hilston asked if there were any items of unfinished business. Dr. Sierk brought up the matter of preparation of an annual report similar to those of the swine and sheep breeding laboratories and indicated that numerous requests had been made for such a report. He asked the Committee members to express themselves as to what should go into the report. After considerable discussion it was agreed to present an annual report and that it should emphasize accomplishments. It was further agreed that since this would be the first annual report, it should contain some detail as to facilities including numbers of animals, etc. Dr. Sierk asked stations to send in as soon as possible any material they wished to go into the report that is not included in the state annual report.

Prof. Pahnish briefly referred to the work the Arizona station has been conducting relative to the dwarf problem. He indicated they were seriously considering expanding this work to include specific matings to determine the relationship between so-called compressed and dwarfism. Motion by Gregory, second by Keith, that the Arizona station be encouraged to investigate this problem. Motion carried.

Dr. Hilston called for the report of the Resolutions Committee. Prof. Knox read the following resolution and moved its adoption:

RESOLUTION

Whereas, the Administrative Adviser has informed the Technical Committee of a plan to discontinue the office of Coordinator for the Western Region, and

Whereas, the services of the Coordinator have contributed greatly to the development of the Beef Cattle Breeding Project in the Western Region, covering about one-half the area of continental United States:

Therefore, this Committee assembled at State College, New Mexico, October 9 and 10, 1951, believing the office of Regional Coordinator to be essential for the efficient functioning of cooperating stations in the region, strongly recommends to the Bureau of Animal Industry that the services of a full-time Coordinator with facilities and clerical personnel necessary for the effective performance of his duties be retained. The Committee believes that in view of the present need for mobilizing agriculture to meet the emergency, it is a particularly inopportune time to discontinue the office of Coordinator in the region, which is the principle source of beef cattle for the nation.

Dr. Kidwell asked if there was an explanation for the decision to discontinue the office of Regional Coordinator.

Dr. Clark read from the notes which he had taken during a conference with Washington officials on September 22, 1951, held during the morning of that date at Beltsville and Washington, D. C. He was notified at that conference that the Bureau preferred not to fill the position of Western Regional Coordinator. Since the position of clerk for the Coordinator had previously been abolished without advice or counsel with the Technical Committee, this would create a complete vacancy at the office of the Western Coordinator and would necessitate a revision in

the work programs of the remaining staff, for the loss of these staff members would mean not a ten per cent cut but a fifty per cent cut.

Dr. Clark indicated that he discussed very fully with the officials concerned the implications incident to such an action if it were followed, and stated how such an action could hardly be justified on the basis of a ten per cent reduction in personnel costs, and that surely other more satisfactory solutions could be found. He pointed out that the current financial status of the project would permit of the continuation of the services of the Coordinator and the clerk, and in any case the Coordinator would have had to be paid through the entire year if he had not elected to transfer to the University of Idaho. Dr. Clark also indicated that in liaison work of the type that he and his staff are engaged in it is almost impossible to get along without clerical assistance, and, in order to discharge the duties of a Coordinator efficiently, clerical assistance far beyond the ordinary requirements of most scientific offices comprises an integral part of the work program of the office concerned. He stated that Dr. Sierk had been quite concerned when he first learned of this loss of clerical force.

Dr. Clark also indicated that some of the cooperating states felt that no action of this kind should be taken without review by the Committee concerned, since the Coordinator is responsible to the Bureau and to the Technical Committee in the Region. He indicated that he had approached the various parties concerned, including the Regional Adviser, and had obtained the reactions of the Committee. He stated that as soon as these were received he had indicated to the Bureau that the Committee in the Western Region did not favor the abolition of the clerical position nor leaving vacant the Western Coordinator position, and neither did the Regional Adviser nor the Directors in the Region. Moreover, the Directors had volunteered to return sufficient funds (personnel) to the Bureau so its Denver office would not be impaired, and the ten per cent cut therefore would be absorbed directly by the cooperating states. This was declined by the Bureau.

Dr. Bartilson was absent from the room when the resolution was first read. He returned during Dr. Clark's review and at the conclusion of this review Dr. Bartilson asked if the resolution would be read again. This was done. Dr. Bartilson then stated that it was not the intent of the Bureau to discontinue the office of Regional Coordinator, and that if Dr. Clark's budget would permit the filling of the position this would be done. He outlined in some detail the actions by the Congress which made necessary consideration of personnel problems by the Bureau in Washington. Director McKee suggested the resolution include the following statement-- "It will be appreciated if the Administrative Adviser is informed of the policy of the Bureau prior to the Land Grant College meeting in Houston, November 13 - 15." The Resolutions Committee agreed to the addition to the resolution.

In the discussion that followed, Director McKee explained that he had corresponded with each Experiment Station director in the Western Region relative to the Regional Coordinator position. He reported that he had received responses from three directors and assumed that the directors had discussed the matter with their respective Technical Committeemen. Each state Technical Committeeman then expressed his station's stand and,

when the question was called for, the motion to adopt the resolution carried unanimously. Dr. N. W. Hilston, Chairman of the W-1 Technical Committee, was instructed to transmit a copy of the resolution to the Bureau of Animal Industry.

Dr. Hilston reported for a committee appointed to make recommendations for incorporating Record of Performance with Visual Appraisal for making awards at the Pacific International Livestock Exposition. These recommendations were requested by Mr. Walter Holt, Secretary and General Manager of the Exposition. After some discussion, motion by Galgan, second by Bogart, that the Chairman appoint a committee to make final recommendations. Motion carried. The following committee was appointed: C. F. Sierk, Chairman; M. E. Ensminger, Ralph Bogart, and N. W. Hilston.

Dr. Hilston asked Director McKee to discuss the 1952-53 9b3 budget allocation. Director McKee distributed a three-page mimeographed report showing 9b3 fund distribution in W-1 beginning in 1948-49 to date, the expenditures by states on W-1 for 1950-51, and a recommended distribution of 9b3 funds for 1952-53. A copy of this report is appended. Director McKee gave the following figures to be written on the first page of the report:

9b3 Funds - 1951-52

NC-1 \$29,500

E-10 \$29,000

W-1 64,000

Bureau Funds - 1950-51

NC-1 \$15,200

E-10 15,500

W-1 26,500

Director McKee moved the approval of the 1952-53 allocation, explaining that the proposed allocation had been reviewed by the Executive Committee. Second by Pahnish. Motion Carried.

Dr. Hilston called to the attention of the Technical Committee the fact that since the last meeting of the Technical Committee five stations had submitted revised or expanded projects. Dr. Sierk explained that copies of these projects had been distributed for comments and suggestions and final drafts prepared by the station and Regional Coordinator, and all had been approved by the Office of Experiment Stations, but that it should be a matter of record in the minutes that these projects had been approved. Moved by Keith, second by Gregory, that the Hawaii project be approved. Carried. Moved by Bogart, second by Galgan, that the New Mexico project be approved. Carried. Moved by Galgan, second by Pahnish, that the Montana project be approved. Carried. Moved by Bogart, second by Willson, that the California project be approved. Carried. Moved by Sierk, second by Willson, that the Wyoming project be approved. Carried.

The Chairman called for new business. Bogart extended an invitation to have the Committee meet in Oregon in 1952. After some discussion it was agreed to leave the matter of time and place for the 1952 meeting to be decided by the Executive Committee. Dr. Hilston reminded the Technical Committee that it was a matter of record in the minutes of a previous Technical Committee meeting that the chairmanship of the Technical Committee would rotate by states alphabetically. No disagreement in this procedure was voiced and the Technical Committeeman from Arizona, Prof. O. F. Pahnish, was declared Chairman for the coming year. Director McKee spoke briefly on the handling of expense accounts and reminded the Committee that there should be no balance as of June 30, 1952. Dr. Charles Grey of the Office of Experiment Stations expressed his appreciation for the opportunity to participate in the meeting, as did Dr. Bartilson of the Bureau of Animal Industry. Dr. Hilston called upon Dr. Clark for comments.

Dr. Clark referred to a talk which he had recently delivered to the Chairmen of Commodity Committees working under R. M. A. while these men were meeting in the Secretary's Conference Room, Washington, D. C., September 18, 1951. He reviewed the early history of the three regional projects and outlined the organization pattern upon which the National project was based. He gave examples of how committees operated with reference to the submission, review and approval of projects, starting with the Technical Committee and going through the regional directors to the appropriate offices, such as the Office of Experiment Stations and the Agricultural Research Administration in Washington, and the Committee of Nine as a functioning organization on regional projects.

He gave examples of how the work under this project had proceeded at a much faster rate, apparently, than on some regional projects. He cited a very considerable number of scientific and popular publications as evidence. He said we should all be encouraged by that in striving to get our project on a more sound financial and scientific basis. He drew attention, particularly, to the state-Bureau-breeder cooperation which now exists in a number of centers, and referred to examples of how industry was taking up the work and pointing the way. Brief reference was given to Gilliam County, Oregon; Sturgis, South Dakota; Durango, Colorado, and other points as centers where industry was in active cooperation with the Experiment Stations and Extension Services under this improvement program. He indicated how certain representatives of the packing industry and the American National Cattlemen's Association were also stressing the use of tested stocks. He referred to the Montana Experiment Station releases with reference to the premiums now being paid in that state for feeder stock sired by tested bulls.

He referred to the fact that it would certainly take much more than the U. S. Department of Agriculture is now spending if we are going to have a proper National program, and that in addition to the sums that are now being put up by the states in the way of capital improvements as well as annual support funds the original plans of the Bureau were pointed toward a much greater annual input from Federal sources to this work than is now being requested or allocated for the program. He indicated that this was distinctly necessary now and wise in the National interest, and could lead to a permanent contribution to increased beef production, a longtime vital need. He stated that we should not be misled

by loose statements to the effect that since the states are putting up money this project does not need any increased Federal support. He said that such a stand would not be fair to the cooperating states, for they were given to understand in the beginning of this effort that the Federal government through the Bureau would try to increase its direct grants in aid to states.

He reviewed the technical personnel now working on the program, of which, in all three regions, there are now 119 persons, of which only 12 are Federal civil servants, and this number does not include a considerably greater number of Extension people and private individuals throughout the country who are assisting in various ways in the application of this work. He referred to the distinct advantages that are accruing from regional projects, and that they have stimulated animal science in this field and related fields, and the benefits to be derived from this stimulus are already in evidence and will continue to increase in importance. They have resulted in a greatly improved status of animal science projects in the cooperating stations and within the Bureau.

He expressed particular appreciation for the assistance which he had received from the Administrator's Office, Agricultural Research Administration, the Office of Experiment Stations, and from the three station directors who have served as Regional Administrative Advisers, namely, Director Clyde McKee of Montana, Dr. Marvel Baker of Nebraska, and Dr. R. E. Patterson of Texas. These men have worked very closely with us and have been particularly helpful in the efforts that we have put forth not only to coordinate the work of the stations themselves but also to coordinate work within the Department of Agriculture itself. He referred to the fact that these men realize the longtime nature of a project like this that compels stability of operation from year to year. He referred to the distinct advantages that have accrued through coordination of this program in the field and said that this had undoubtedly resulted from the fact that free opportunity to exercise unreviewed action and decisions on the research was a necessary part of the activities of the coordinators working in this program. He expressed the view that he would impose only one prerequisite on regional projects of this kind: that anyone connected with the administration of a regional project should have previously served in an administrative or research capacity in a state experiment station and, therefore, understand Federal-state relations.

He stated that the resources and scope of the program have greatly increased through the combining of all resources, and, therefore, more different phases of research could be tackled through joint programs of this kind. He referred to the fact that the rest of the Bureau's cattle work, in such fields as livestock management and related fields is now being operated out of a single field headquarters at Denver near the center of the industry in whose interests we work. That decision, as to location of headquarters, made by Dr. Simms, Dr. McPhee, and Dr. Byerly, and approved by Dr. Cardon, has helped tremendously in keeping our program closely allied to the industry and to the field stations that are undertaking research work. He stated that this would be a continuing aid, for it has already resulted in the smoothest and quickest application of some of our early research results to industry. He stated that probably more important than the actual increases in knowledge which accrue from the research is the fact that we have already stimulated a large number of

breeders to do a better job with their own herds. To some of these men in industry we owe a great deal. They realize, some of them for the first time in their experience, how research can pay off. Dr. Clark presented a summary of the State contributions to the National cattle breeding research program as of June 30, 1951. These data are included in an appendix to the minutes.

Prof. Willson moved that the Technical Committee go on record as being appreciative of the services of the Regional Coordinator, Dr. Sierk. Dr. Sierk expressed his thanks to the Committee for their very fine cooperation, and assured the Committee of his continued interest in W-1.

Meeting adjourned at 3:00 P.M.

- APPENDIX A -

9(b) 3 FUNDS FOR W-1

	1946-47	1947-48	1948-49	1949-50	1950-51	1951-52	TOTAL	1952-53
ALASKA			--	--	--			
ARIZONA		1,600	--	2,600	2,500	2,500	9,200	
CALIFORNIA		--	--	--	--	3,000	3,300	
COLORADO		2,400	--	8,650	8,550	8,300	27,900	
HAWAII		--	--	--	--	--		
IDAHO		--	--	5,250	5,150	5,000	15,400	
MONTANA		1,800	--	4,700	4,600	5,000	16,100	
NEVADA		--	--	3,100	3,000	3,400	9,500	
NEW MEXICO		1,600	--	9,400	9,300	9,000	29,300	
OREGON		1,600	--	9,300	9,200	8,900	29,000	
UTAH		1,570	--	8,550	8,450	7,690	26,260	
WASHINGTON		1,200	--	6,850	6,750	6,140	20,940	
WYOMING		--	--	3,100	3,000	3,500	9,600	
PLANNING & COORD	2,300	2,300	1,424.17	1,500	1,461	1,570	10,555.17	
TOTAL	2,300	2,300	13,194.17	63,000	61,961	64,000	206,755.17	

EXPENDITURES REPORTED ON W-1 BY STATES: 1950-51

STATE	Bureau 10(b)	R.M.A. 9(b)3	R.M.A. 9(b)1&2	State Funds	Grants	Total Expended
ALASKA	--	--	--	--	--	--
ARIZONA	1,800.00	1,281.46	740.68	2,800.00	--	6,622.14
CALIFORNIA	2,800.00	--	--	19,155.00	--	21,955.00
COLORADO	3,400.00	6,627.96	2,394.18	13,830.23	2,395.00	28,647.37
HAWAII	--	--	--	--	--	--
IDAHO	--	5,161.34	7,500.00	3,842.90	4,500.00	21,004.24
MONTANA	2,400.00	4,700.00	--	29,000.00	--	36,100.00
NEVADA	2,000.00	3,100.00	9,044.64	11,966.44	1,200.00	27,311.08
NEW MEXICO	3,960.00	7,940.77	3,609.98	7,889.29	--	23,400.04
OREGON	4,800.00	9,785.60	--	30,251.40	--	44,837.00
UTAH	1,982.00	8,442.33	5,128.92	15,343.64	--	30,896.89
WASHINGTON	3,000.00	6,938.96	4,022.67	18,529.11	--	32,490.74
WYOMING	--	3,100.00	5,215.00	22,347.83	--	30,662.83
TOTALS	26,142.00	57,078.42	37,656.07	174,955.84	8,095.00	303,927.33

- APPENDIX B -

STATE CONTRIBUTIONS TO NATIONAL CATTLE BREEDING RESEARCH PROGRAM

INVENTORY AS OF JUNE 30, 1951*

	Cattle		Acres	Physical Facilities		Total	Cattle and Physical Facilities
	Head	Value		Value	Buildings and Other		
Southern Region	5,479	\$1,340,785	14,695	\$ 907,953	372,189	\$1,280,142	\$2,620,927
North Central Region	2,839	676,590	13,705	917,425	344,650	1,262,075	1,938,665
Western Region	4,639	1,407,730	64,098	1,047,290	904,442	1,951,732	3,359,462
Total	12,957	\$3,425,105	92,498	\$2,872,668	\$1,621,281	\$4,493,949	\$7,919,054

*These data include all cattle on Federal Stations but do not include land and physical facilities on these Stations.

RECOMMENDED DISTRIBUTION - 9(b)3 FOR W-1: 1952-53

STATE	ALLOCATED	1952-53			Prop. Inc.
		1951-52	No Inc.	50% Inc.	100% Inc.
ALASKA	---	---	---	---	---
ARIZONA	2,500	2,500	4,000	4,000	1,500
CALIFORNIA	3,000	3,000	5,000	5,000	2,000
COLORADO	8,300	8,300	9,300	9,300	1,000
HAWAII	---	---	3,000	3,000	3,000
IDAHO	5,000	5,000	6,500	6,500	1,500
MONTANA	5,000	5,000	7,500	7,500	2,500
NEVADA	3,400	3,400	5,000	5,000	1,600
NEW MEXICO	9,000	9,000	9,500	9,500	500
OREGON	8,900	8,900	9,600	9,600	700
UTAH	7,690	7,690	8,000	8,000	310
WASHINGTON	6,140	6,140	7,100	7,100	960
WYOMING	3,500	3,500	5,000	5,000	1,500
PLANNING & COORD.	1,570	1,570	2,500	2,500	930
TOTAL	64,000	64,000	82,000	82,000	18,000

COMMITTEES APPOINTED AT THE W-1
TECHNICAL COMMITTEE MEETINGS AT
STATE COLLEGE, NEW MEXICO

October 9 and 10, 1951

(1) Possibilities of Pooling Data

Ralph Bogart, Oregon State College; Chairman
C. F. Sierk, Regional Coordinator

(2) Qualitative Inheritance

P. W. Gregory, University of California; Chairman
Dr. Kidwell, University of Nevada

(3) Carcass Evaluation

C. B. Roubicek, University of Wyoming; Chairman
E. P. Margerum, Jr., University of Wyoming

(4) Selection and Record Forms Committee

Fred Willson, Montana State College; Chairman
Ralph Durham, New Mexico State College
C. E. Safley, University of Arizona
Jim Ingalls, Ft. Lewis A and M College, Colorado
H. H. Stonaker, Colorado A and M College

(5) Feed Utilization

J. A. Bennett, Utah State Agricultural College; Chairman
T. B. Keith, University of Idaho
M. W. Galgan, Washington State College

(6) Pacific International Performance Evaluation

C. F. Sierk, Regional Coordinator; Chairman
M. E. Ensminger, Washington State College
Ralph Bogart, Oregon State College
N. W. Hilston, University of Wyoming

